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AUTHOR	Pisapia, John
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ABSTRACT

Four schools with technology rich environments were studied to gain a better understanding of the impact of technology infusion in schools. The four schools selected were a rural high school, a suburban middle school, an urban elementary school, and an urban high school. Cross case analysis shows certain characteristics these schools shared. All were characterized by adaptability and the ability to change to suit the circumstances. Each of these schools had a vision of how the technology would be used. In all cases the principal and the media center coordinator were important to maintaining the momentum of the implementation. Planning efforts were diverse, and ranged from the top-down strategy of one school to the bottom-up planning of another. In one school, the small size of the school allowed technology implementation to proceed informally. Several barriers to innovation had to be overcome in these schools, but planning made it possible to overcome staff and community resistance. Implementation of educational technology must be seen as a journey and not an event. (SLD)

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Research Brief #9

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LESSONS LEARNED FROM TECHNOLOGY INTENSIVE SCHOOLS

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The purpose of this research brief is to report the findings of a study of four technology intensive schools. This study was conducted in order to gain a richer understanding of the impact of technology infusion in schools. Urban, suburban, and rural schools were equally considered.

The following three criteria were used to select schools for this study. In order to be selected for this study, a school must have had 1) a technology-rich environment for at least two years, 2) a backbone network must have been available at the school, and 3) the use of technology to support higher-order thinking skills must have been part of the curriculum.

Four sites which met these criteria were selected: a rural high school, a suburban middle school, an urban elementary school, and an urban high school. A case study protocol was developed and used by the tour member site teams to guide their observations. The four schools were examined in order to identify determinants of successful uses of technology. Based on team observations and on the comments from the participants, a narrative on each school was prepared. Then, inferences were drawn which can assist schools in the early stages of technology infusion.

The observations and inferences are reported here through a cross case analysis. It examines the indicators of successful technology infusion, identifies problems encountered, and discusses the variables most important to success.

Adaptability

Adaptability was a characteristic found in each of the four schools. In its simplest terms, adaptability is the ability to change. Change, however, is never easy. It involves a never ending struggle to construct, articulate, and live a vision.

Technology intensive schools tend to be open, cheery, and adaptable to change. For example, one school had a change in principalship after only two years of implementation. Another school changed from traditional curricula to thematic curricula, and then to a closer approximation of traditional curricula. A third school converted from a high use of technology to a lower use of technology and from high stress to low stress.

Vision

The schools each had a vision for how technology would contribute to student learning. However, technology was used differently in each of these schools. Two schools openly promoted technology as a tool. Another school promoted technology as a "safety net" so students would not falter on basic skills. The "tool" schools had an absence of integrated learning systems (ILSs). In the "safety net" school, ILSs were present, but not to the exclusion of problem-solving and tool applications.

On the other hand, in each school, technology was seen as an integral part of the educational process not as a supplement. Instructional needs drive the applications, as the schools' ideals indicated: "Children first, instruction second, and technology last," "Instructional decisions first then technology," or "Curriculum is supported by the technology."

A strong rationale for the use of technology in all schools was the belief that "technology must be a required student experience if they are to be equipped for 21st century job skills." There was little mention of technology to promote increased learning even though it certainly played an important role in two of the schools' plans.

Each school had a "visionary-type" leader, the title of whom varied. At one school, it was the superintendent--at another, the central office staff. The principal took on the visionary role at a third school. At the fourth school, a team of enthusiastic teachers and an equally helpful central office staff create a collaborative vision.

Visionaries are important for idea generation, but we also found "keepers of the vision" who maintain the momentum through implementation. In at least two cases the media center coordinator and a few key faculty members serve

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this function. In another case it was the principal. A "visionary" superintendent also nurtured implementation at another school. In all cases, the principal and the media center coordinator were important to maintaining the momentum.

Beliefs and visions are the bases of several types of decisions. As we described, they determine the instructional emphases that the technology supports. They also determine the type of technology software which is purchased and used. One school made drill and practice software available on the network. In another school, the principal refused to purchase such software. Finally, administrators expressed that beliefs and visions were a consideration in hiring new employees.

Planning

The nature of planning, while evident in three of the four schools, was diverse. One school used a 'top-down' strategic planning process which influenced curriculum and technology purchase decisions, as well as building architecture. Here, planners created an environment and then identified people who would be successful in this environment.

A 'bottom-up' process was employed at another school as the principal, faculty, and vendors all responded to a magnet school grant. The central staff strategically developed criteria at a third school, to which interested schools responded through an RFP process.

In the fourth school, the small size of the school and its school division allowed technology planning to proceed through informal conversations and through teacher modeling rather than through formal strategic plans. They described this as "just in time" planning. However, strategic planning was used in this school division to procure grants for long term planning.

What seems to be important is that as technology becomes more complex through school-wide information access and data management networks, the need for comprehensive planning becomes more acute.

The following concerns tend to disrupt the planning process: whether or not to purchase an infrastructure to support hardware before one purchases the hardware; computer laboratories versus computers in the classroom; and the idea that, as one commentator described, "Planning without access to technology is worthless." Parents and students were apparently not involved in the decision-making process.

Implementation

Several barriers had to be overcome by these schools. One reason innovation fails is that it simply is not accepted by the users. They passively or actively resist the innovation for various reasons (extra work involved, fear for one's job, lack of feeling of ownership in the innovation). An inadequate support structure for using the innovation (training, supporting documentation, maintenance) is another reason for failure. Each school confronted both of these barriers and overcame many of the obstacles facing successful implementation through planning and time..

The nature of planning can directly influence implementation. For example, disjointed implementation depends upon an informal modeling by technology-using teachers who attract other users to create a strong, if not small, cadre of technology-using teachers. However, disjointed implementation processes can lead to uneven implementation. For example, when teachers who want to use technology are nurtured and others who do not want to use it are not penalized, assessment of progress can be more difficult.

Implementation appears to be a journey, not an event. It is a journey that must be planned for, nurtured and guided. One school indicated it took four years for them to integrate technology into their daily instructional program. Others accomplished it more swiftly, by using only traditional uses of technology. Contemporary uses (tools) take longer. Complete implementation was not observed in any of the four schools.

However, in every case there seemed to be a similar sequence each school went through. In the first two years, one could expect the following barriers to impede implementation: physical problems with the hardware (especially networks and the dependability of the equipment); lack of technical assistance and/or time to learn how to integrate technology into classrooms and teaching; funding to venture into newer technologies; and an over dependency on drill and practice software. The network "was down more than it was up" during the first two years of its use at one school.

Beginning the implementation sequence with a "change conference," or a summer training and curricular development program followed by on-site nurturing of a school-based technology committee was observed at two schools. This "focusing event" and "hand holding" strategy appeared to benefit these schools.

Like the schools they work in, teachers also go through a similar implementation sequence. They generally begin the sequence by learning to use technology as a utility and productivity tool. They elevate from using drill and practice and tutorial applications in their teaching. In three to five years, teachers usually graduate to the use of technology for problem-solving, simulations, and tool applications.

These school and teacher sequences are known and dependable. They can and should be enhanced through sound implementation plans.

Technology Applications

Instruction drives technology and is limited by it. In all cases, the schools were technology-rich; with well equipped media centers. Computer automated card catalogues, CD ROM Databases, access to telecomputing, computer checkouts, VHF antennas and satellites for instructional television reception, networked laboratories, and classroom networks are all the norm for these schools rather than the exception.

The technology differed only slightly at these schools. One school had an intercommunication delivery network without a computer network, although one was on the drawing board. In another case, one computer in each classroom is connected to the school network. In other cases, there are at least four computers in each classroom connected to the school network as well as a networked computer on each teachers desk. At this time, multimedia technology was limited to the science area at each school.

Instructional Applications

The integration of technology into every day instruction is an "art on the cutting edge." Only a few accomplished integrators were found, even though a significant number of teachers want to integrate technology. On the other hand, collaborative teaching and cooperative learning were evident in these schools. Telecomputing as a way to integrate technology was observed in a few classrooms. The use of the technology as a tool was observed in three of the four schools.

However, traditional uses of technology still persist, even in these technology-rich schools. Only lead teachers have significantly changed their instructional practices to make full use of the technology.

Traditional assessments were still the norm in each of the schools observed. These teachers, and the teachers in the tool-oriented schools, recognize that they need new evaluation techniques. However, they feel they do not have time to develop them on their own.

Keyboarding was a major "gate keeper" to advanced uses of computer technologies by students. It limits teacher adoption of advanced uses of technology in their classrooms. Keyboarding skills are seen by teachers as a major barrier to more sophisticated uses of technology even in the elementary school. Teachers at all the schools felt keyboarding skills should be introduced as low as the third grade.

The location of computers is another limiting factor in integrating the technology into instruction. In all cases, teachers want the classrooms to be more of a focus of technology use rather than having it be the labs and media centers. Even though they recognize the frustrations of keeping the equipment running and available in the classroom, some teachers feel going to a computer lab is a step backwards. In one case, the classroom laboratory had been disconnected because of dependability problems. This forced teachers to start "marching their kids down to the centralized lab."

Technology Integration

Several incentives were identified to aid in the integration of technology such as finding time to plan curriculum and to have access to computers after school and at home. In all cases, training and the availability of computers in the classroom was seen as significant barriers to successful technology integration.

Training

Teachers appear to have an insatiable need for more technology training. Teachers in each school cited training as a strong need, even in the schools where considerable quality training had been offered.

Technology-using teachers in the four schools tended to be self-taught and were assisted by either a lead teacher, a media specialist, or other teachers. Teachers placed particular value on one-on-one training from a colleague.

Training that is more specific and curricular-related was identified as the most important type of training once teachers were familiar with basic usage.

Tuition support, stipends for summer training, and released time to attend training sessions were all seen as positive incentives. There was a definite bias against after school and weekend training.

Software

The lack of appropriate "tool" software was identified by teachers in three of the four schools. These schools seem tied to the MECC applications. Teachers desired software from other sources, or at least better software from MECC. Even in the software-rich school, teachers wanted more and better software.

Two of the schools were hampered by inadequate budgets for software. They tended to use regular allowances for the media center as their source of funds.

There were a variety of ways software was purchased. At one school, teachers recommended purchases to the media specialist. The technology committee reviewed and recommended purchases at another. In other cases the lead teacher and media specialists advised teachers of available software. There did not appear to be any systematic review of software in any case studied.

Administrative Support

Administrative moral support was reported as positive in all four schools. In some cases this moral support led to changing scheduling plans to gain flexibility, planning time, and more hardware and software, to forming computer committees, and seeking grants to support the technology.

Facilities

An encouraging note about these schools is that three of the four were housed in old buildings that had been retrofitted for technology. While such remodeling posed its own problems such as the need for larger rooms and for electrical access and conduits for cables, they seemed to work well. For all cases, even in the new building, flexibility was a desired educational specification.

Administrative Uses

In all cases teachers perceived a net benefit to them regarding the administrative uses of technology. In some schools many administrative tasks (attendance, lunch counts, lesson planning, grading, communications through QuickMail or E-mail) had been facilitated through the addition of technology.

Personal computers were valuable to teachers. Several teachers mentioned that if they ever had to teach in another school they would buy their own classroom computer if one was not provided. One special education teacher noted that the electronic IEP had reduced production time from six hours to thirty minutes.

John Pisapia

Phone: 804/828-1332
FAX: 804/828-0479
Internet: JPISAPIA@CABELL.VCU.EDU

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